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MONTHLY DIURNAL AVERAGE GERB PRODUCTS FOR Obs4MIPs

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SUMMARY

The existing GERB radiances and fluxes are available to users in HDF5 (Harries et al. 2005). They are presented on an equal viewing angle grid at a temporal resolution of around 15 minutes.

It has been a longstanding aim of the project to provide the products in a form more compatible with climate model output. That is, monthly averages and diurnally resolved monthly averages on a regular longitude latitude grid, in a CF-compliant netCDF format.

A proposal for a monthly diurnal average GERB derived product has been submitted to Obs4MIPs. Contribution of such an average in the framework of CMIP-5 is not possible as variables with this form of time coordinate are not defined in the outputs. A variable request from the CFMIP for monthly hourly averages as part of CMIP-6 output will resolve this situation. As a consequence of the CMIP6 data request a new time coordinate definition has been included and necessary updates to CMOR are in process to enable its use for the production of these products.

To realise a monthly diurnal average GERB derived product, the GERB observations must be regridded to a regular longitude-latitude grid and the data for each hour averaged over the month. The effect of missing data needs to be considered and appropriately handled and the error characteristics of the data must be detailed.

MISSING REFLECTED SOLAR FLUX DATA

GERB's geostationary orbit provides broadband observations for a portion of the globe with unprecedented temporal frequency. However under certain conditions, such as low sun or when observing the ocean approaching glint conditions, the conversion of observed solar radiances to flux is problematic. Coupled with the fixed viewing geometry this situation presents specific issues to providing diurnally resolved monthly averages.

For SZAs > 80° and ocean glint angles < 15° scene identification, needed to enable the radiance the flux conversion is problematic.

The flux in twilight conditions (SZA 85°-100°) is not reliably inferred from the radiance and local scene but needs to be considered to create unbiased averages.

The observed radiances for clear ocean scenes observed for glint angles <25° can not be reliably converted to flux and these observations need to be filled with monthly climatological values to avoid biasing averages.

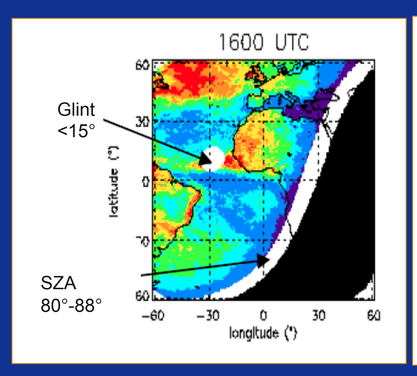

FIGURE 1 Regions of missing fluxes for a single time-step due to glint and low sun observation conditions. Contemporaneous scene identification is not possible for these conditions.

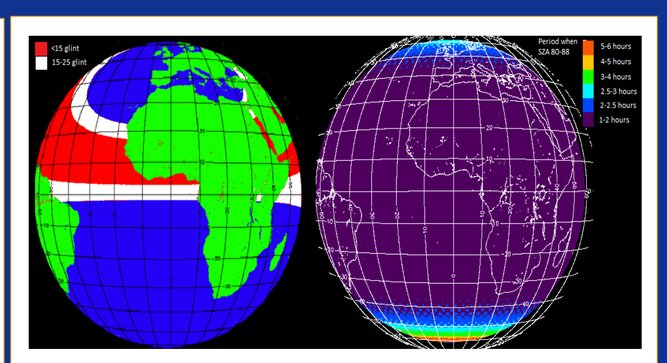

FIGURE 2. Missing data for June 2004. Left hand plot shows the ocean region where the glint angle falls below 15° at some point during the day in red and the region which falls within the range 15 to 25° at some point in the day in white . Right hand plot shows contours indicating the numbers of hours in a day when the solar zenith angle is in the range 80 to 88°.

FILLING THE DATA

The missing data occurs every day at the same time, so averages without trying to account for it will be biased. The approach taken by GERB is to use the observed radiance where possible, extrapolating the scene identification from an earlier or later at a time when the solar geometry was more favourable. By this means a scene estimate is obtained for SZA 80°-85° and over ocean when then the glint angle is <15°.

Where the radiance can not be reliably converted to flux (clear ocean scenes for glint angle <25° and twilight conditions (SZA 85-100°) climatological ocean and twilight flux values are used.

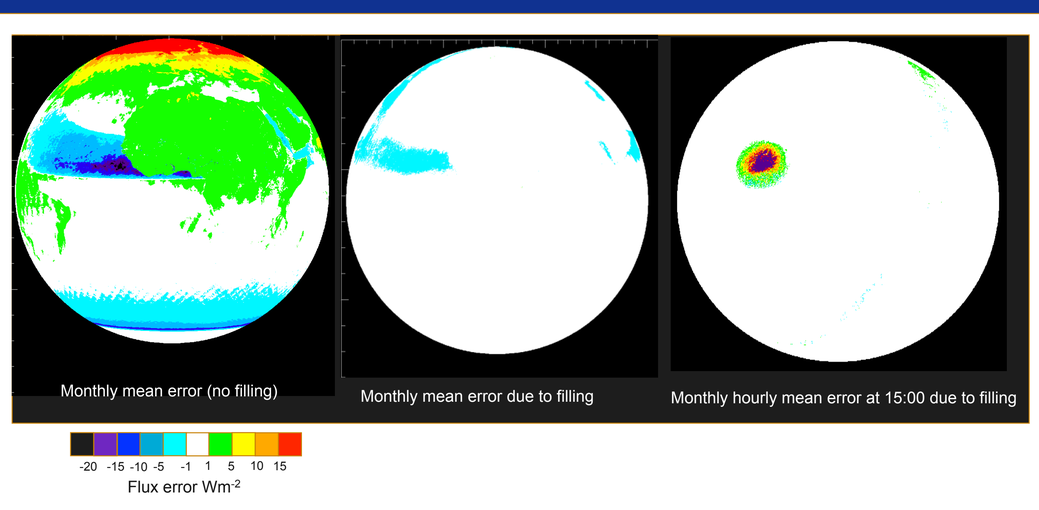

FIGURE 3 Estimates of the bias in the mean for June 2004. Left: bias in the monthly mean if missing data is ignored (filled with the mean of non-missing points). Middle: estimated bias in the monthly mean due to filling using scene extrapolation. Right: estimated bias in the 15:00UTC monthly hourly mean due to filling using scene extrapolation.

PRODUCING AVERAGE PRODUCTS

The record from GERB 2 and GERB 1 covers the period May 2004 to December 2013 for the region 60N-60S / 60E-60W. Only months not interrupted by eclipse operations will be averaged (May, June, July and November, December, January). GERB HR fluxes are used as the starting point for creating averages. These are on a regular equal viewing angle grid, available every 15 minutes of the day.

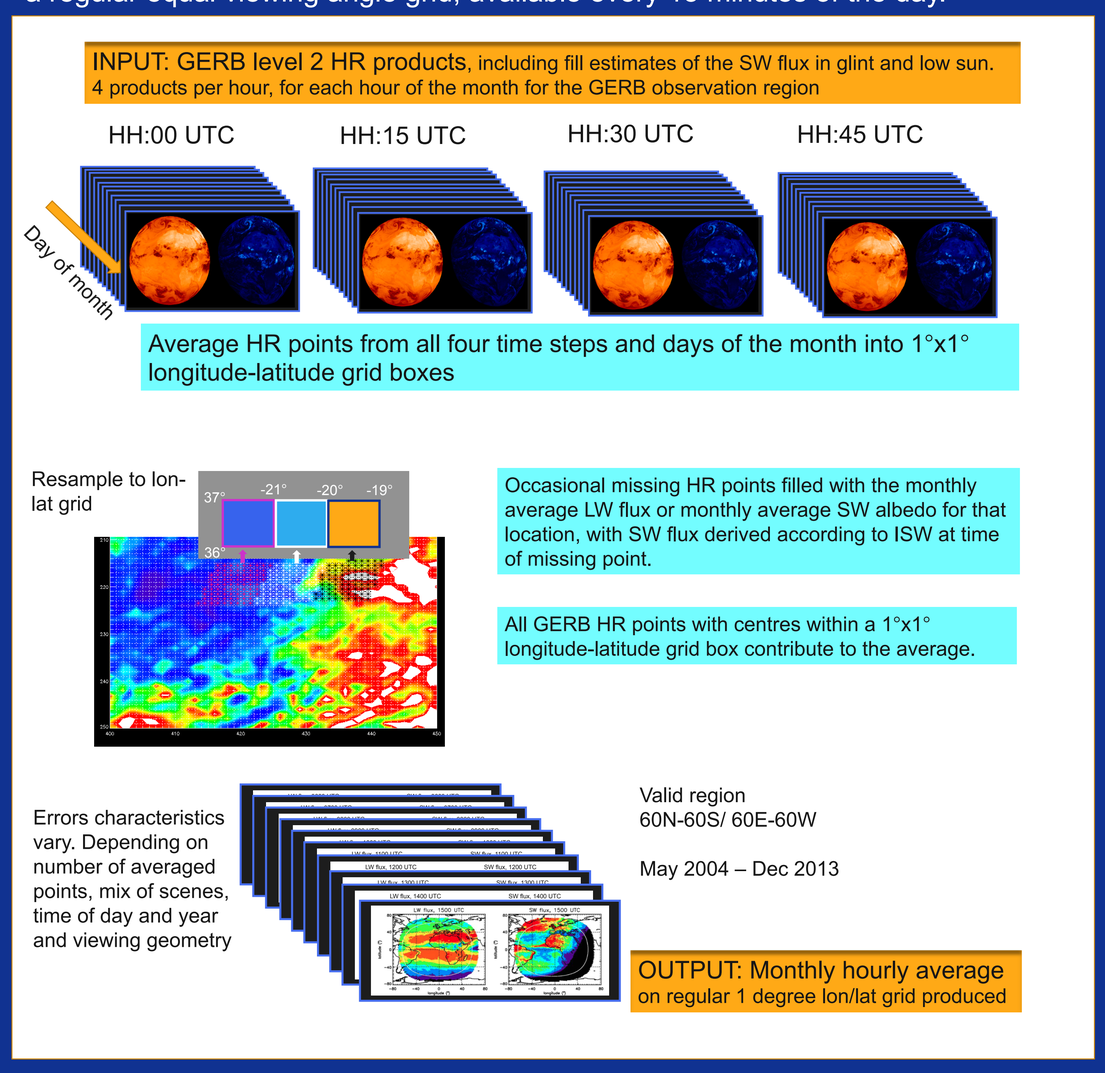

FIGURE 4 GERB HR data to monthly hourly average on regular longitude latitude grid

EXAMPLE PROUDCTS

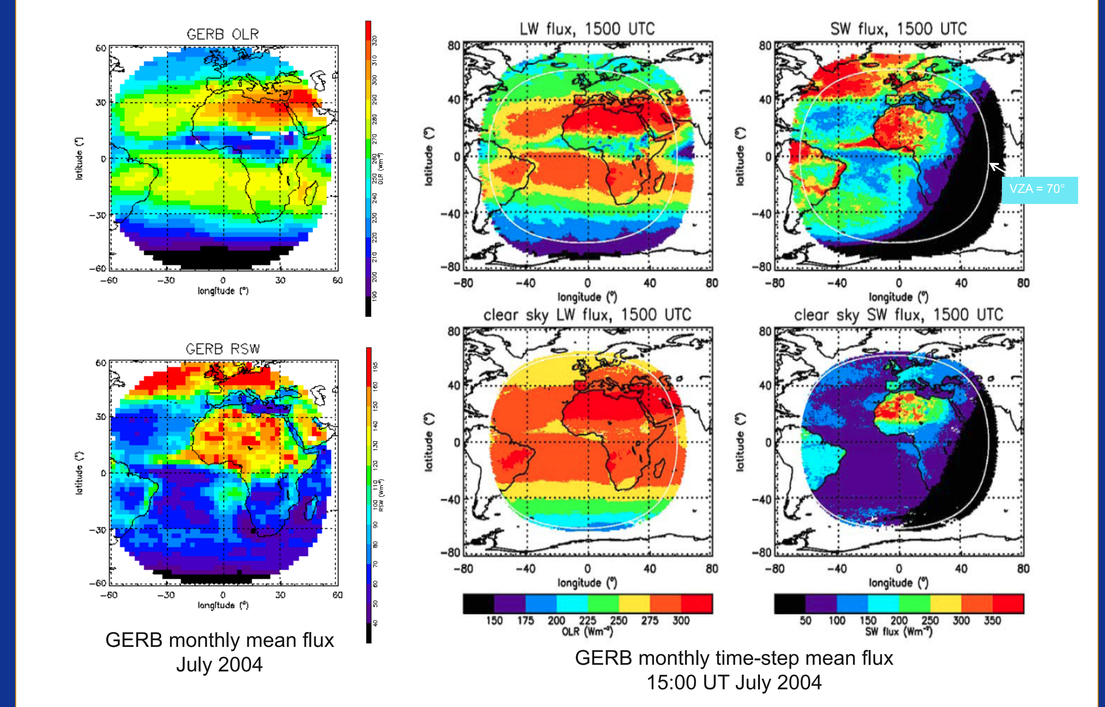

FIGURE 5 July 2004 OLR and RSW TOA fluxes. Monthly mean (left) and 15:00 UTC monthly time step mean (right). Valid values will be limited to the GERB viewing zenith of 70° which is indicated in the fight hand panel.

REFERENCES

Harries, et al. (2005). Bulletin of the American Meteorological Society, 86(7), 945−960.